STATUS REPORT

WATER POLLUTION IN THE SERPENT RIVER BASIN

1976

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Ontario
Ministry of the Environment

R. E. Moore
Director
Northeastern Region

STATUS REPORT

WATER POLLUTION IN THE SERPENT RIVER BASIN

1976

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WATER RESOURCES ASSESSMENT
NORTHEASTERN REGION

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SUMMARY AND CONCLUSIONS

Owing to the implications of radioactivity to human health, concentrations of radionuclides remain the greatest area of concern in the Serpent River Basin. Based on the results of this study, levels of radioactivity as reflected by radium (Ra-226) showed a significant decrease between 1970 and 1975, however, overall Ra-226 activity in the system as measured near the river mouth remained slightly above the permissible level for public surface waters. The greatest degree of radioactive contamination was found in the Pecors Lake sub-basin - an effect of drainage from inactive tailings areas formerly used by Stanrock and Can Met uranium mines. Although Ra-226 activity in the Quirke Lake sub-basin as measured at the inlet to Quirke Lake (downstream of mining activity), only slightly exceeded the suggested criterion, relatively high levels of radioactivity were present in Quirke and Whiskey Lakes. These elevations in Ra-226 activity may be attributable to the relatively long residence times of the lakes (i.e. Quirke Lake est. 3-5 years) or non specific sources such as tailings spills and/or waste rock dumps. The flow of contaminated waters from the Pecors and Quirke Lake sub-basins results in contamination of the downstream reaches of the Serpent River.

Generally, low levels of Ra-226 activity were recorded in the Elliot Lake sub-basin, however, the relatively high radioactivity found in Sheriff Creek is of concern.

Low pH continues to be the major limiting factor to the aquatic biota in the Serpent River basin. Based on Water Quality Monitoring (WQM) data, generally, only relatively minor changes in pH (usually small increases) occurred in the Serpent River system between 1970 and 1975. In the Quirke Lake sub-basin upstream of Quirke Lake and the Elliot Lake sub-basin, pH approached or met suggested guidelines for fish and aquatic life protection while significantly lower pH was recorded in the Pecors Lake sub-basin.

Accessory data collected on lakes in the basin during 1975 indicate that the pH depression problem is much more severe in some lakes in the watershed including Pecors, Quirke, McCarthy and Whiskey, than indicated by WQM data (stream stations). The low, continuously declining pH of these lakes is evidence of a serious ongoing problem - likely a consequence of the oxidation of sulphides present in the tailings wastes and/or the relatively long residence time of waters in the basin.

Although at present, low pH is the major constraint to aquatic communities in the Serpent River basin, the high

concentrations of ammonia recorded in the system are of major concern. During the present study, toxic concentrations of free ammonia were recorded only below the two active mining and milling sites - a direct function of an abundant ammonia supply and neutral pH at these locations. Elsewhere in the system, toxic concentrations were not reached due to low pH and a less abundant ammonia supply, however, since ammonia toxicity is a direct function of increasing pH, the potential for a serious problem exists if pH is elevated.

The abundant concentrations of dissolved solids (TDS) particularly sulphate, in the system are of concern although as with ammonia, their significance is overridden by the effect of depressed pH. Generally, concentrations of TDS and sulphate showed a decrease between 1970 and 1975, reflecting a decrease in inputs of these materials from the abandoned tailings areas. The only locations showing increases of TDS and sulphate in 1975 were those below the active mining and milling sites - a direct effect of inputs of these materials through mining and milling activity. It appears that an elevation in these materials may be a necessary consequence of mining and milling in the basin.

In conclusion, it appears that in general, significant reductions in Ra-226 levels have occurred throughout the system and lesser decreases in concentrations of

ammonia, TDS and sulphate were recorded at sites not affected by active operations. Downstream of mining and milling activity, high loadings of ammonia, TDS and sulphate continued. Although pH in the system showed a slight increase at key stream stations, a continuous pH decrease, and resultant problematic levels, were identified in several lakes of the basin.

Drainage from the abandoned tailings area of Stanrock and Can Met uranium mines appears to be the major contributor to radioactive contamination and pH depression in the basin while the greatest elevation of ammonia, TDS and sulphate occurs below the presently active mining and milling operations.

RECOMMENDATIONS

(1) A program of pH and Ra-226 control should be implemented as soon as possible on the drainage from the inactive tailings area of Stanrock and Can Met uranium mines. A similar programme should be initiated on Sheriff Creek.

(2) An investigation into the reason for the continuing low pH and elevated Ra-226 activity in lakes of the Quirke and Pecors Lake sub-basins should be undertaken with a view to estimating recovery times of affected waters. Based on the results of such a study, an investigation of the feasibility of reclaiming selected lakes may be warranted.

(3) Methods of reducing concentrations of ammonia and other nitrogen compounds, including recovery procedures, should be investigated.

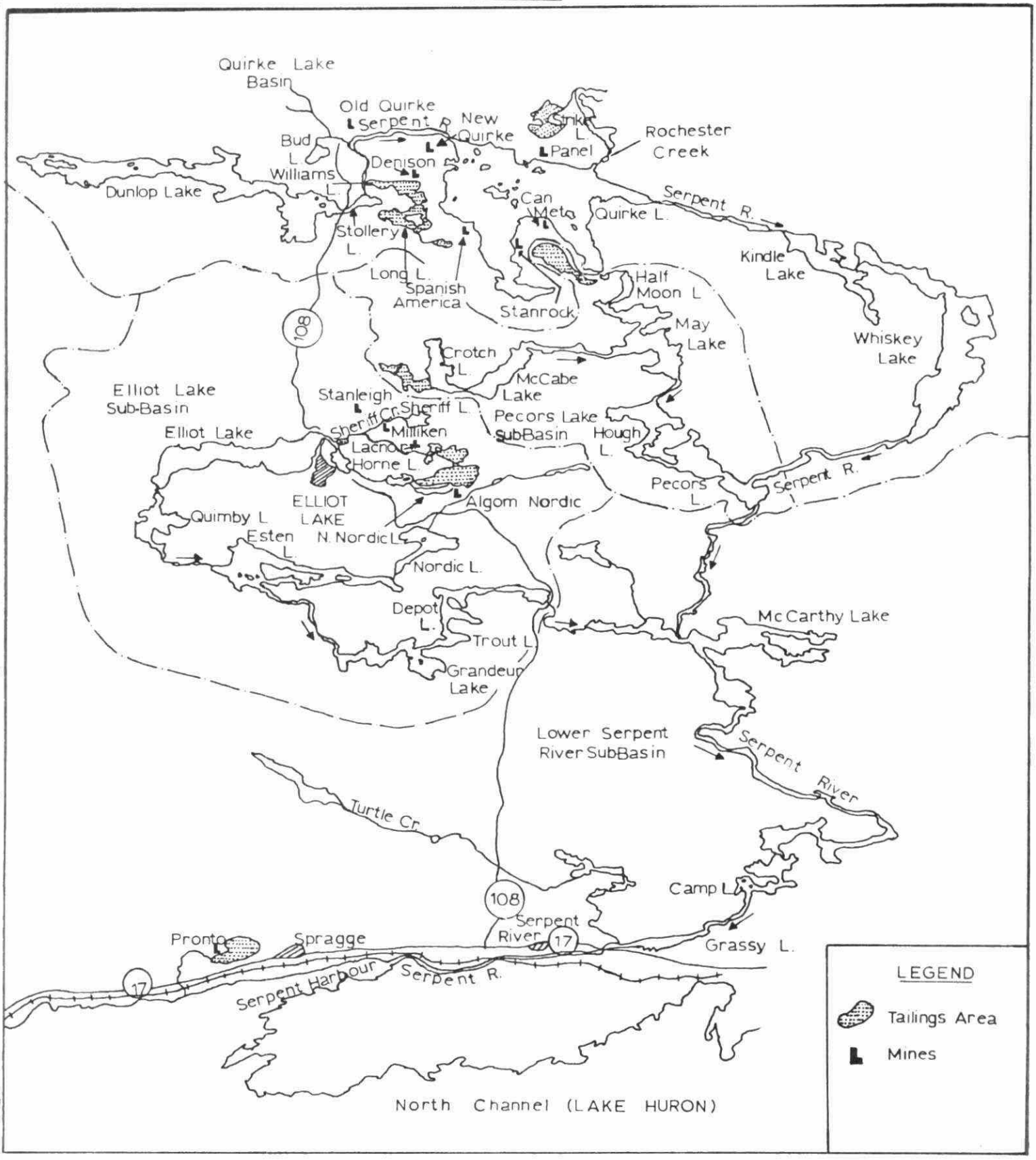
(4) Recognizing the necessity of increasing dissolved solids concentrations in order to maintain suitable pH, efforts should be made to keep loadings of dissolved solids as low as practicable.

BACKGROUND

The Ontario uranium mining industry commenced in 1953 with the discovery of a large uranium - bearing ore body in the Serpent River basin. Sparked by a large uranium market, this deposit was developed rapidly with eleven mines commencing operation by 1957. Subsequently, reduction in the world uranium demand reduced the number of operating mines to five by 1966. The continued uncertainty of markets further reduced mining activity in the Serpent River basin until in 1972, there were only two operating mines. Stimulated by the present energy crisis the demand for nuclear fuels has shown a dramatic increase and production at the existing mines in the Serpent River basin has increased accordingly since 1972. Figure 1 is a map of the Serpent River basin showing flow patterns within the basin and the locations of existing and abandoned mine sites and tailings disposal areas.

Surveillance of waste control operations in the Serpent River basin by the Ontario Water Resources Commission (now Ministry of the Environment) began in 1957 with emphasis on containment of mill wastes and investigation of chemical pollution of receiving waters. In 1958, studies of possible radioactive contamination were commenced by the Ontario Dept. of Health. The results of these

FIGURE 1
THE SERPENT RIVER BASIN



surveillance programmes were summarized in a Deputy Ministers' Report[1].

Based on the recommendations of that report, a major investigation of water quality in the Serpent River as related to mining activity was carried out from 1966 to 1969. The findings of that study were summarized by the Ontario Water Resources Commission (OWRC)[2]. The OWRC report identified water quality problems related to mining activity in the basin and provided recommendations for protective and remedial measures.

From 1970 to the present, a programme of radiological and chemical water quality monitoring has been carried out at selected locations in the Serpent River basin in order to identify continuing water quality problems and document improvements due to implementation of the suggested waste control recommendations. The following report compares the status of the basin in 1970 to conditions in 1975 and discusses the data in light of improvements in water quality and continuing problems.

STATUS OF THE BASIN IN 1970

The 1971 report by the OWRC[2] indicated that serious radiological and chemical pollution was evident throughout the Serpent River basin downstream of Stollery Lake.

Increases in radium (Ra-226) activity of 50 to 200 times background levels (1 pCi/l) in certain lakes of the Pecors and Quirke Lake sub-basins represented the greatest degree of radiological impairment. Levels of Ra-226 decreased with distance downstream, however, levels of 8 to 10 times background remained at Serpent Harbour.

Generally, overall levels of radioactivity as indicated by Ra-226 activity showed little change between 1960 and 1970, however, some localized improvements attributable to improved waste handling practices did occur. Despite these improvements radiation levels remained significantly above background.

Serious pH depression and significant increases in the levels of dissolved solids, sulphate and ammonia were the main impairments in the chemical quality of waters in the Serpent River basin. Severe impairment of biological conditions in the basin due to degraded water quality was evident. Biological problems included reduced phytoplankton, zooplankton and fish populations and depressed bottom fauna communities.

Generally, chemical and biological impairment of the system was greatest proximal to pollution sources with some improvement evident with increasing distance downstream. Concentrations of dissolved solids and sulphates showed a gradual reduction between 1966 and 1970, however, generally no improvement in pH occurred, with values continuing to decrease, even in lakes downstream of neutralization sites.

Based on the OWRC report[2] radiological contamination was identified as the major concern in the Serpent River basin, because of the implications to public health. Next in importance was the low pH of the watershed and resultant depression of aquatic biological communities. The high concentrations of ammonia, total dissolved solids, and sulphate recorded in the basin were considered potential problems to aquatic life however their importance was overshadowed by the influence of depressed pH. Further, any detrimental effects of radioactivity on aquatic communities were masked by the more significant effects of chemical impairment.

PRESENT STATUS OF THE BASIN

WQM data for selected stations in the Serpent River basin during 1970 and 1975 are provided in Tables A and B of the appendix. A summary of the locations and station codes of the sampling sites is provided in Table C of the appendix.

The data are discussed below under the headings: Radiation Levels, pH, Ammonia, Total Dissolved Solids and Sulphate, and pictorial comparisons of the data between 1970 and 1975 (Figures 2 to 6) are provided under the respective headings.

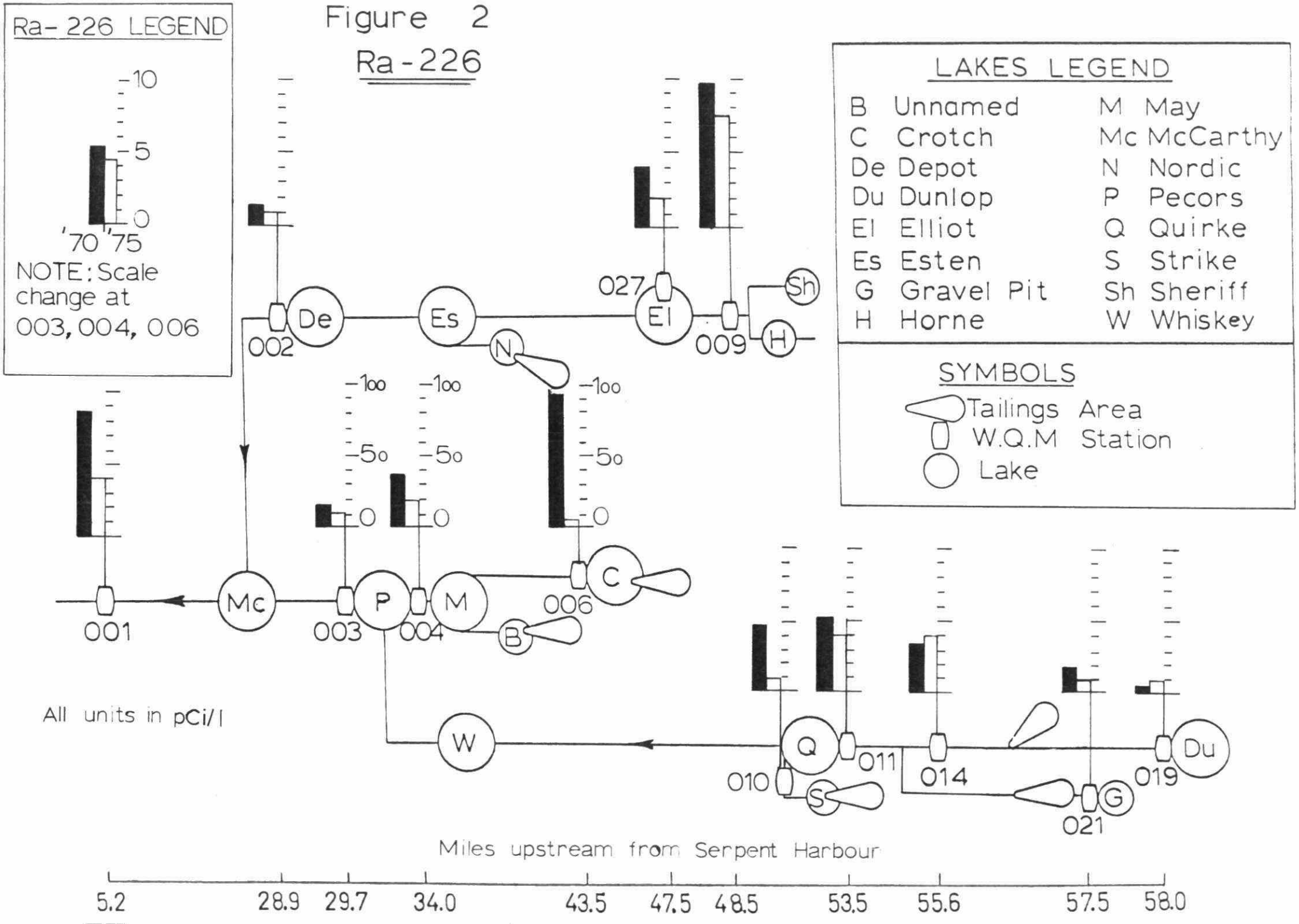
RADIATION LEVELS

Figure 2 is a schematic comparison of Ra-226 levels in the Serpent River basin between 1970 and 1975. It is evident from the figure that generally, levels of radioactivity showed a significant decrease from 1970 to 1975, however, overall Ra-226 activity as measured near the river mouth remained slightly above the concentration considered permissible for domestic water supplies (3 pCi/l)[3].

Ra-226 activity in the Elliot Lake sub-basin was generally low in 1975, with mean levels of 2 and 1 pCi/l at Elliot Lake and the outlet of Depot Lake, respectively. The relatively high activity recorded at Sheriff Creek (mean of 7.5 pCi/l) upstream of Elliot Lake is of concern, particularly since Elliot Lake is the drinking water source for the Town of Elliot Lake. Downstream waters including the domestic water supply exhibited acceptable radiological quality.

Figure 2

Ra-226



In the Quirke Lake sub-basin, low levels of radioactivity (1pCi/l) were recorded in 1975 at the outlets of Dunlop and Gravel Pit lakes, while downstream at the inlet to Quirke Lake, Ra-226 levels had increased to 4 pCi/l due to the influence of tailings drainage or the loss of radium precipitates to the watercourse. Accessory data show a greater degree of radioactive contamination in the downstream portion of the Quirke Lake sub-basin than indicated by the value recorded at the inlet to Quirke Lake. Levels of 9 and 8 pCi/l were recorded at Quirke and Whiskey lakes respectively during 1975. The apparent discrepancy between lake-water activity and activity in the major contaminated inflows may result from non-specific sources such as spillages of radioactive tailings at Panel and Stanrock mines or it may reflect the influence of the relatively long residence times of Quirke and Whiskey lakes. Ra-226 activity in Rochester Creek, the inflow from Strike Lake, was low (1pCi/l).

The Pecors Lake sub-basin exhibited the greatest degree of radioactive contamination in 1975, with a mean Ra-226 level of 20 pCi/l at the inlet to Pecors Lake. At the outlet of Pecors Lake Ra-226 activity had reduced to 11 pCi/l, probably due to dilution by drainage from the Quirke Lake sub-basin. Since a level of only 6 pCi/l was recorded at the outlet of Crotch Lake, it appears that the major contributor to the radioactive contamination of the Pecors Lake area, and therefore, the downstream portion of the

Serpent River watershed is inflow from the un-named lake designated B on Figure 2. This lake receives drainage from the inactive tailings area formerly used by Stanrock and Can Met urnaium mines. The contamination of the Pecors lake sub-basin may also be a reflection to some degree of the retention of radionuclides in lakes of the sub-basin.

WATER CHEMISTRY

pH

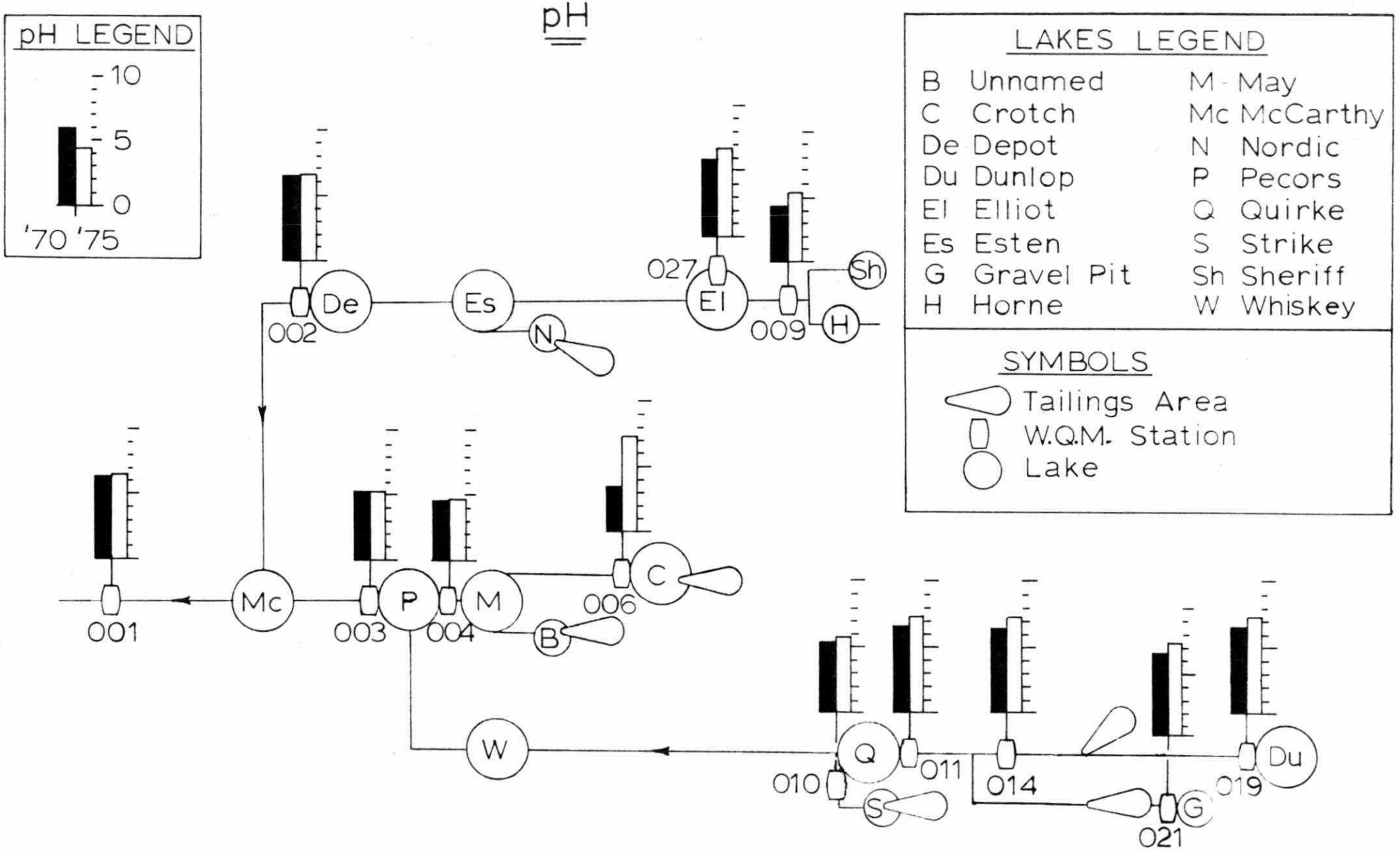
As shown in Figure 3, the WQM data indicate that only relatively minor changes in pH have occurred in the Serpent River basin between 1970 and 1975. At certain locations, pH increases due to the implementation of the improved waste control measures recommended by the OWRC[2] were noted, however, generally pH in the system remained relatively low.

The Serpent River at Highway 17 (Station 001) - considered representative of overall conditions in the watershed, had a mean pH of 6.5 in 1975, only slightly above the mean pH in 1970 (6.1). The mean pH in 1975 (6.5) barely meets the suggested guidelines for protection of fish and aquatic life (6.5 to 8.5[3], 6.3 to 9.0[4]). pH values at several of the upstream monitoring stations were well below the suggested satisfactory range. Judging by the pH of upstream reference stations the Serpent River has a naturally acid pH in the range 6 to 7.

In the Pecors Lake sub-basin, the outlet of Crotch Lake showed a significant pH increase from 1970 to 1975 (means of

Figure 3

pH


pH LEGEND
10
5
0
'70 '75
LAKES LEGEND
B Unnamed
C Crotch
De Depot
Du Dunlop
El Elliot
Es Esten
G Gravel Pit
H Horne
M May
Mc McCarthy
N Nordic
P Pecors
Q Quirke
S Strike
Sh Sheriff
W Whiskey
SYMBOLS
Tailings Area
W.Q.M. Station
Lake
De
Es
N
El
Sh
H
002
027
009
Mc
P
M
C
B
001
003
004
006
W
Q
S
010
011
014
G
021
Du
019
Miles upstream from Serpent Harbour
5.2
28.9
29.7
34.0
43.5
47.5
48.5
53.5
55.6
57.5
58.0

3.3 and 7.2 respectively), however downstream at the outlet of May Lake, pH remained low (4.6 and 4.7 for 1970 and 1975 respectively). The depressed pH below May Lake reflects the effect of inflow from the un-named lake (B) which receives tailings drainage from the inactive Stanrock and Can Met mines. Below Pecors Lake, pH remained unchanged (5.1) between 1970 and 1975.

The Elliot Lake sub-basin showed a negligible pH change between 1970 and 1975 at the outlet of Depot Lake (6.6 to 6.7) while at Elliot Lake an increase from 5.9 to 6.8 occurred. An increase of a similar magnitude was recorded at Sheriff Creek, upstream of Elliot Lake, however pH (5.5) remained unacceptable for fish and aquatic life [3,4] in 1975.

The Quirke Lake sub-basin from the outlet of Dunlop Lake to the inlet of Quirke Lake exhibited acceptable pH in 1975 with mean values in the range 7.2 to 7.3. These values represent slight elevations over the pH in 1970 (6.5 to 6.7). The pH of the inflow from Strike Lake (Rochester Creek) remained low (5.9) in 1975 although a slight increase since 1970 (5.5) was noted.

From the foregoing it appears that a slight pH increase occurred in the basin between 1970 and 1975 and that generally pH values in the Elliot Lake sub-basin and the portion of the Quirke Lake sub-basin upstream of Quirke Lake approached or exceeded the suggested lower limits for protection of fish and other aquatic life. In the Pecors Lake sub-basin, a significant pH increase occurred at

the outlet of Crotch Lake, however, despite this improvement, unacceptable pH levels persisted in the downstream waters.

It is important to note that the values reported herein represent water quality monitoring data collected at stream stations only. Based on accessory data collected by the Ministry of the Environment on selected lakes during 1975, it is apparent that the WQM data do not adequately reflect the magnitude of the depressed pH problem in the Serpent River basin. Table 1 provides a summary of the pH of selected lakes in 1975 and compares this data with values for the period 1966 to 1969 as provided by OWRC[5]. It is evident from Table 1 that severe pH depression existed in Pecors, Quirke, McCarthy and Whiskey lakes during 1975 with values ranging from 4.2 to 5.1. As shown in the table, pH exhibited a relatively continuous decline in Pecors, Quirke and Whiskey lakes between 1966 and 1975, despite the improved condition at the inlet to Quirke Lake. Elliot Lake showed a slight decline in pH during the same period, however, levels remained acceptable. The pH of Nordic Lake showed a decline from 1966 to 1969, however in 1975, the pH was similar to that in 1966. McCarthy Lake showed an acceptable, fairly constant pH from 1966 to 1969, however a significant decrease occurred between 1969 and 1975. Dunlop Lake, upstream of mining activity, showed a fluctuation in pH during the 1966 to 1975 period but no significant reduction.

TABLE 1

SUMMARY OF pH DATA FOR LAKES IN THE SERPENT RIVER BASIN, 1966 to 1975

LOCATION	pH			
	66-67[1]	67-68[1]	68-69[1]	75[2]
PECORS LAKE-Top inlet from Hough Lake	6.7	6.7	5.8	4.2
PECORS LAKE-Bottom near Outlet	6.6	5.9	6.0	4.3
NORDIC LAKE	6.5	5.8	5.1	6.6
QUIRKE LAKE	5.7	5.6	5.5	4.5
DUNLOP LAKE	6.4	7.0	7.4	6.5
McCARTHY LAKE	6.8	6.7	6.8	5.1
WHISKEY LAKE	6.6	6.3	5.8	4.4
ELLIOT LAKE	7.1	6.9	6.3	6.5

1. data from OWRC[5] (yearly means)
2. data from supplementary investigation by M.O.E. (one date)

As outlined above, the degree of pH depression in Pecors, Quirke, McCarthy and Whiskey lakes is considerably more severe than indicated by the WQM data from stream stations (Figure 3). For example, Quirke Lake had a low pH (4.5) in 1975 although the pH of the inflow to the lake was acceptable (7.3). The pH depression observed in these lakes is likely due to the continuous oxidation of large quantities of sulphides present in the tailings wastes, low pH contributions from waste rock dumps and tailings seepage and/or the relatively long residence time of hydrogen ions in these basins. The pH depression of lakes in the Pecors and Quirke Lake sub-basins is of extreme concern since it is evidence of a serious ongoing problem.

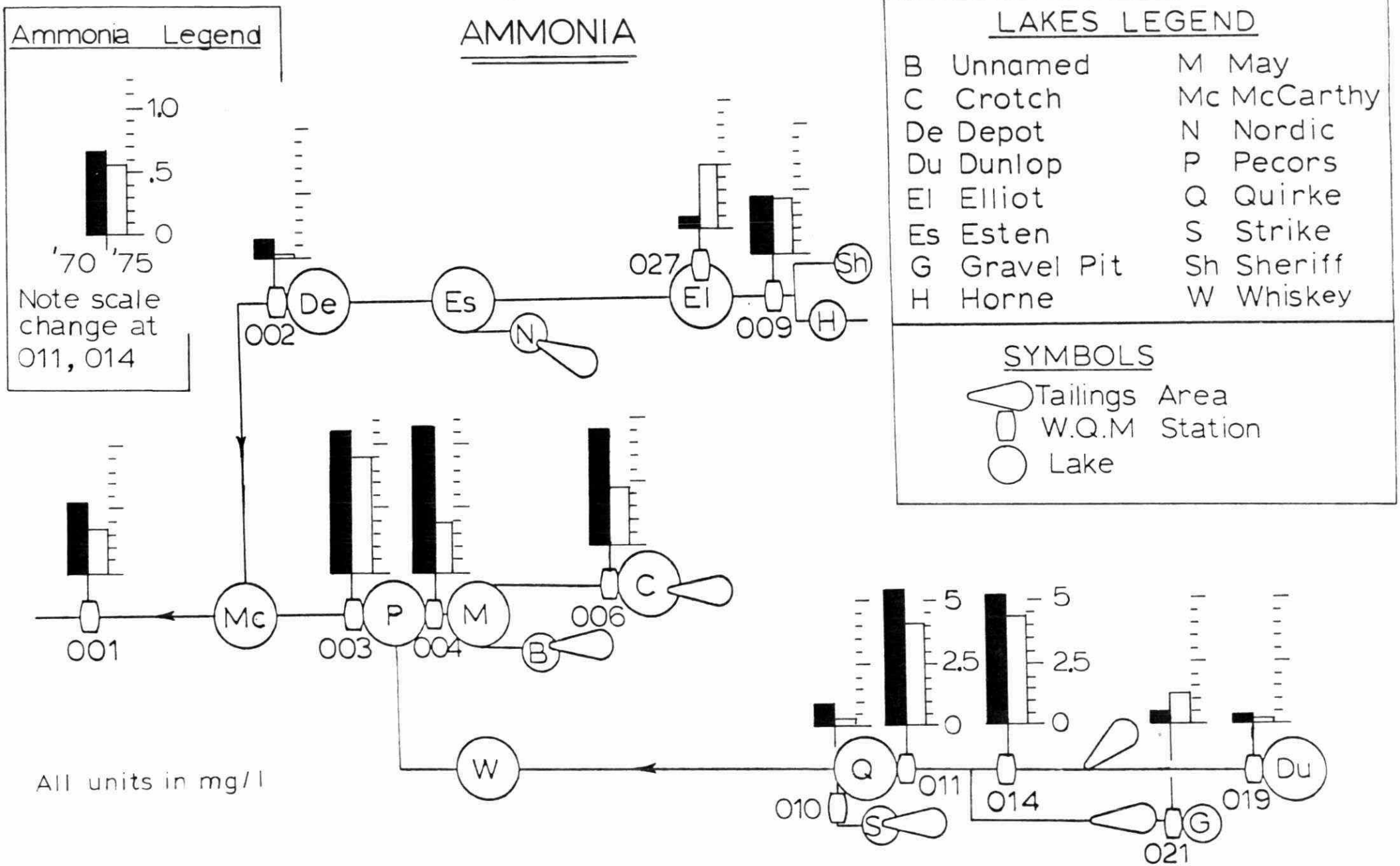
Ammonia

As indicated in Figure 4, concentrations of ammonia in the Serpent River basin generally showed a decrease between 1970 and 1975. Despite this decrease, ammonia levels in the basin remained generally high.

It has been indicated[4] that unpolluted rivers generally have low ammonia concentrations, usually less than 0.2 mg/l. It is evident from Figure 4, that values approaching 0.2 mg/l occurred only at the outlets of Dunlop, Gravel Pit, Strike and Depot lakes Throughout the rest of the system, concentrations of ammonia were significantly higher with yearly mean values ranging from 0.35 to 4.4 mg/l in 1975.

Figure 4

AMMONIA



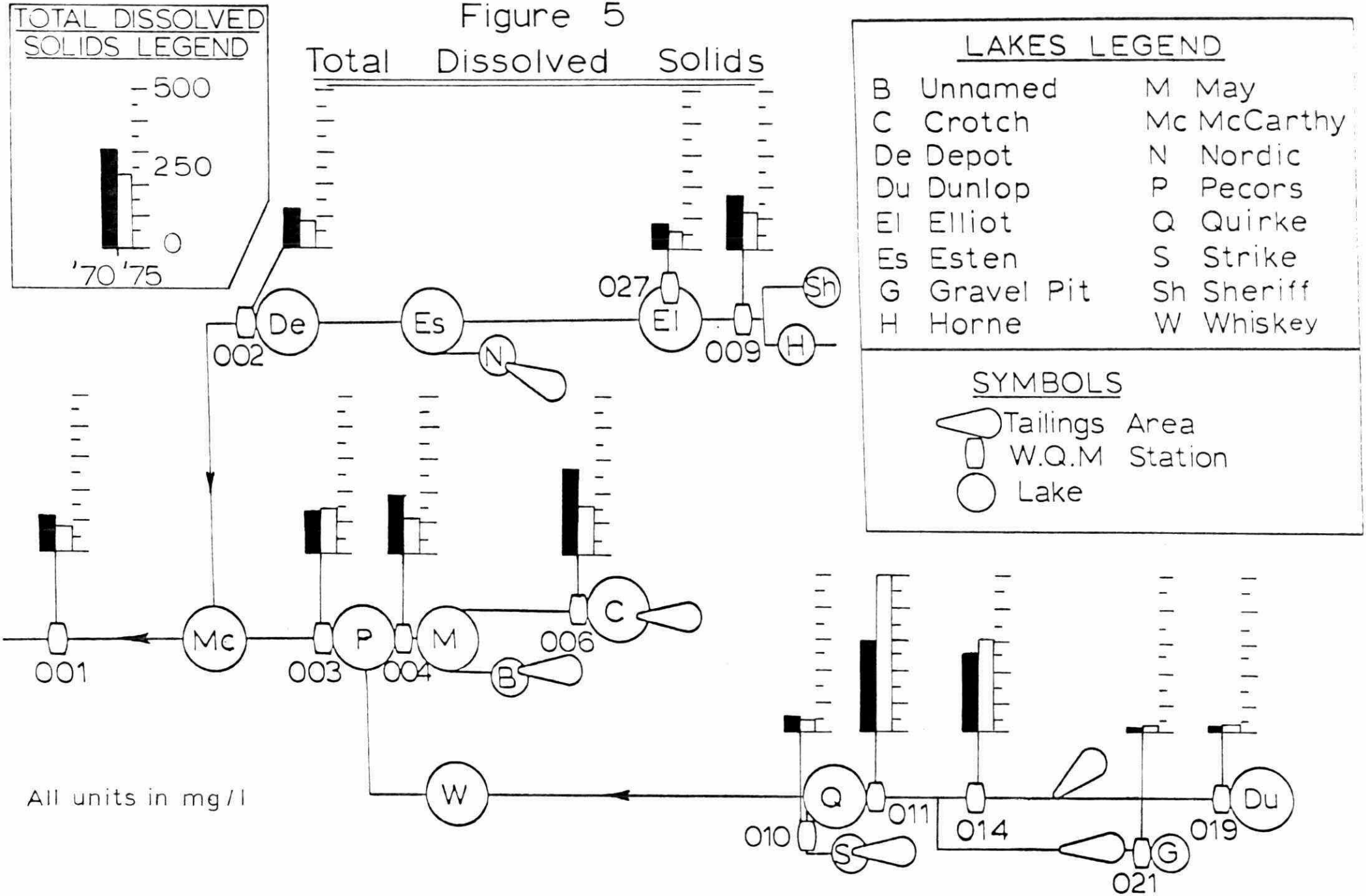
The toxicity of ammonia to aquatic life is a direct function of temperature and pH. Ammonia toxicity increases markedly with increases in these two variables. In the portion of the Quirke Lake sub-basin downstream of discharges from the two active mills, where pH was relatively high and ammonia was very abundant, potentially toxic concentrations of free ammonia were recorded. Due to the generally lower pH and lower ammonia concentrations in the rest of the Serpent River basin, it is unlikely that significant ammonia toxicity occurs elsewhere at present, however the potential for a serious problem exists should waste treatment practices result in higher pH in the system.

Total Dissolved Solids

The overall concentration of dissolved solids in the basin as measured near the river mouth (station 001) has decreased slightly between 1970 and 1975 (mean of 83 and 55 mg/l respectively - See Figure 5). These values are well below the desirable upper limit for public surface waters [3] (< 200 mg /l). Stations 011 and 014 - upstream of Quirke Lake had relatively high concentrations of TDS in 1975 (500 and 312 mg /l respectively), a reflection of inputs of materials, primarily sulphates, from mining and milling activity and lime additions for pH control. The remaining stations in the watershed had TDS concentrations well within the suggested desirable criterion.

Figure 5

Total Dissolved Solids



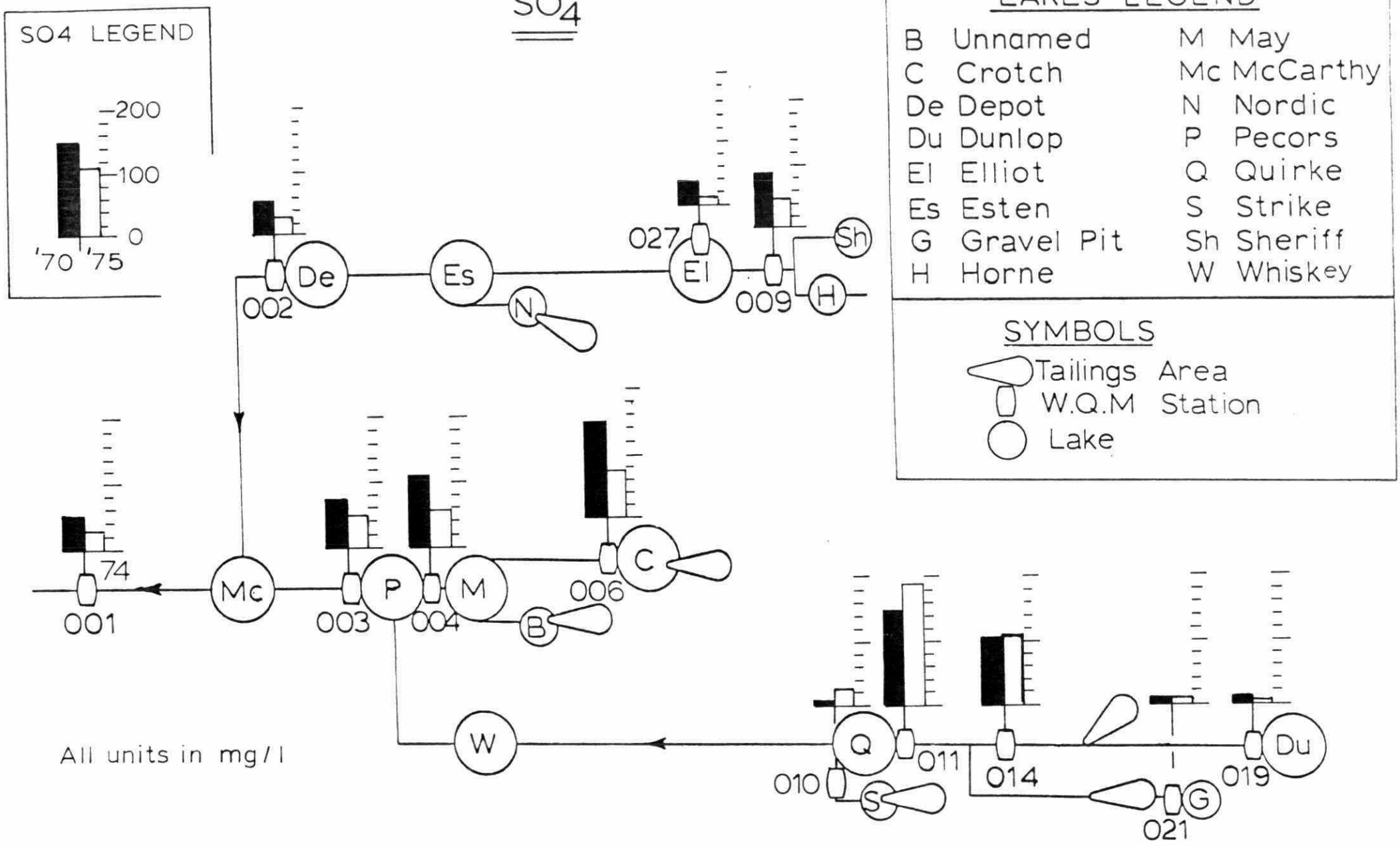
Based on the above, concentrations of TDS in the Serpent River basin appear generally acceptable from a public surface water aspect, however, if Ministry of the Environment fish and aquatic life guidelines[3] are considered, a further concern comes to light. It is suggested by Ministry of the Environment that "dissolved materials should not be added to increase the concentration of dissolved solids by more than one-third of the natural condition of the receiving water, owing to potentially harmful osmotic effects of high concentrations". As shown in Figure 5 background concentrations as measured at the outlet of Dunlop lake are in the 30 to 40 mg/l range. From the figure, it is evident that elevations of TDS exceeding one-third the natural background concentration are present throughout the Serpent River basin as a result of tailings drainage and mining and milling activities.

Sulphate

Generally, concentrations of sulphate have shown a decline in the Serpent River basin between 1970 and 1975 (Figure 6). The only locations exhibiting increases in sulphate between 1970 and 1975 were stations 011 and 014 - which are immediately downstream of active mills, and station 010. Based on the above it appears that sulphate loads to the Serpent River from old tailings areas are gradually reducing while the active tailings disposal areas continue to produce large loads.

Figure 6

SO_4


SO4 LEGEND
200
100
0
'70 '75
LAKES LEGEND
B Unnamed
C Crotch
De Depot
Du Dunlop
El Elliot
Es Esten
G Gravel Pit
H Horne
M May
Mc McCarthy
N Nordic
P Pecors
Q Quirke
S Strike
Sh Sheriff
W Whiskey
SYMBOLS
Tailings Area
W.Q.M Station
Lake
All units in mg/l
Miles upstream from Serpent Harbour
5.2
28.9
29.7
34.0
43.5
47.5
48.5
53.5
55.6
57.5
58.0

Although sulphate levels in the Serpent River basin remain elevated over background concentrations, yearly means do not exceed the permissible Ministry of the Environment criterion for public surface water supplies (< 250 mg/l). Yearly mean values in the Quirke and Pecors Lake sub-basins do, however, exceed the desirable Ministry of the Environment criterion (< 50 mg/l).

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1. Deputy Ministers' Committee, 1965. Report on Radiological Water Pollution in the Elliot Lake and Bancroft Areas.

2. Ontario Water Resources Commission, 1971. Water Pollution from the Uranium Mining Industry in the Elliot Lake and Bancroft Areas, Volume 1 - Summary.

3. Ministry of the Environment, 1972. Guidelines and Criteria for Water Quality Management in Ontario.

4. McKee, J.E. and H.W. Wolf, 1963. Water Quality Criteria. California State Water Resources Control Board.

5. Ontario Water Resources Commission, 1972. Water Pollution from the Uranium Mining Industry in the Elliot Lake and Bancroft Areas, Volume 2 - Detailed Findings.

APPENDIX

TABLE A

MEAN CONCENTRATIONS OF SELECTED PARAMETERS

SERPENT RIVER BASIN, 1970 and 1975

STATION No.	Ra – 226 (pCi)		pH		Ammonia (mg/l)		T.D.S. (mg/l)		SO_4 (mg/l)	
	70	75	70	75	70	75	70	75	70	75
001	8.7	4	6.6	6.8	0.54	0.38	114	83	55	32*
002	1.5	1	6.6	6.7	0.13	0.03	123	87	57	33
003	16	11	5.1	5.1	1.1	0.90	136	148	70	52
004	38.2	20	4.6	4.7	1.1	0.39	196	117	115	57
006	93.8	6	3.3	7.2	0.90	0.45	271	153	148	77
009	9.8	7.5	4.3	5.5	0.44	0.42	179	121	81	47
010	4.9	1	5.5	5.9	0.19	0.08	57	48	7	24
011	5.2	4	6.7	7.3	5.5	4.1	291	500	152	192
014	3.5	4	6.5	7.3	5.2	4.4	260	308	115	117
019	0.4	1	6.7	7.2	0.08	0.03	28	32	16	7.5
021	2	1	6.6	7.3	0.10	0.25	35	38	10	10
027	4	2	5.9	6.8	0.09	0.50	75	53	32	15

* Value from 1974 data

TABLE B

RANGE IN CONCENTRATION OF SELECTED PARAMETERS

SERPENT RIVER BASIN, 1970 and 1975

STATION No.	Ra — 226 (pCi/l)		pH		Ammonia (mg/l)		T.D.S. (mg/l)		SO_4 (mg/l)	
	70	75	70	75	70	75	70	75	70	75
001	4 - 13	3 - 6	6.2 - 7.4	6.6 - 7.0	0.38 - 0.70	0.28 - 0.46	85 - 135	60 - 98	32 - 73	19 - 44*
002	0.5 - 3	1 - 2	6.3 - 6.9	5.4 - 7.5	0.03 - 0.34	0.02 - 0.04	105 - 135	65 - 107	37 - 70	14 - 46
003	13 - 19	9 - 13	4.1 - 6.1	4.9 - 5.5	7.0 - 1.3	0.70 - 1.1	125 - 145	115 - 190	47 - 80	10 - 70
004	30 - 50	7 - 26	4.3 - 4.8	4.2 - 5.8	0.15 - 1.6	0.19 - 0.51	185 - 215	70 - 137	68 - 160	20 - 85
006	74 - 117	3 - 8	3.2 - 3.5	6.1 - 8.7	0.50 - 1.4	0.30 - 0.60	195 - 360	70 - 215	71 - 230	26 - 155
009	5 - 18	4 - 12	4.1 - 4.8	4.2 - 7.4	0.12 - 0.96	0.03 - 0.90	145 - 195	41 - 235	47 - 98	23 - 77
010	1 - 24	1 - 2	4.1 - 6.5	4.1 - 8.0	0.02 - 0.53	0.01 - 0.14	25 - 100	33 - 65	5 - 10	14 - 36
011	2 - 10	3 - 6	6.3 - 7.3	6.9 - 7.6	2.0 - 10	1.2 - 7.0	135 - 565	247 - 696	38 - 340	62 - 400
014	1 - 9	3 - 5	5.8 - 7.3	6.6 - 8.0	0.08 - 15	0.95 - 7.0	70 - 690	146 - 386	21 - 320	7 - 260
019	0.06 - 1	1 - 1	6.1 - 7.6	6.8 - 7.7	0.03 - 0.14	0.01 - 0.06	20 - 40	11 - 53	6 - 59	5 - 11
021	2 - 2	1 - 1	5.6 - 8.2	7.0 - 7.7	0.01 - 0.30	0.11 - 0.41	25 - 85	32 - 50	5 - 14	8 - 12
027	3 - 5	1 - 3	5.7 - 6.0	5.9 - 8.0	0.09 - 0.09	0.01 - 0.10	55 - 95	19 - 65	29 - 35	2 - 29

* Values from 1974 data

TABLE C

SUMMARY OF LOCATIONS AND STATION CODES

OF THE SAMPLING SITES

LOCATION	STATION NUMBERS		
	Present Report	OWRC[5]	WQM Network
Serpent River at Hwy 17	001	57-1	14-0019-001-02
Outlet of Depot Lake	002	52-2	14-0019-002-02
Outlet of Pecors Lake	003	38-1	14-0019-003-02
Inlet to Pecors Lake	004	37-1	14-0019-004-02
Outlet of Crotch Lake	006	34-1	14-0019-006-09
Sheriff Creek at Hwy 108-Elliot Lake	009	45-1	14-0019-009-02
Rochester Creek	010	59-1	14-0019-010-02
Serpent River-Inlet to Quirke Lake-Panel Mine Side Road	011	24-2	14-0019-011-02
Serpent River Hwy 108 and Panel Mine Side Road	014	24-1	14-0019-014-02
Outlet of Dunlop Lake	019	18-2	14-0019-019-02
Gravel Pit Lake	021	22-6	14-0019-021-02
Elliot Lake Municipal Pumphouse	027	48-2	14-0019-027-01

NOTE: Station numbers used in the present report correspond to the station identification sequences (7th, 8th, and 9th digits) of the location codes used in the Water Quality Monitoring (WQM) network